



TFT LCD Approval Specification

MODEL NO.: N154I2-P02

Customer : _____

Approved by : _____

Note :

記錄	工作	審核	角色	投票
2006-09-07 11:37:16 CST	Approve by Dept. Mgr.(QA RA)	tomy_chen(陳永一/52720/54140/43150)	Assignee	Accept
2006-09-06 14:15:16 CST	Approve by Director	teren_lin(林添仁/56910/36064)	Director	Accept



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**REVISION HISTORY**

Version	Date	Section	Description
Ver. 2.0	Sep, 06 '06	-	N154I2-P02 Approval Specifications was first issued °

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The N154I2-P02 is a 15.4-inch TFT LCD cell with driver ICs and a 30-pin-and-1ch-LVDS circuit board.
The product supports 1280 x 800 WXGA mode and can display up to 262,144 colors. The backlight unit is not built in.

1.2 FEATURES

- WXGA (1280 x 800 pixels) resolution
- DE (Data Enable) only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface
- RoHS Compliance

1.3 APPLICATION

- TFT LCD Notebook
- TFT LCD Monitor
- TFT LCD TV

1.4 GENERAL SPECIFICATIONS

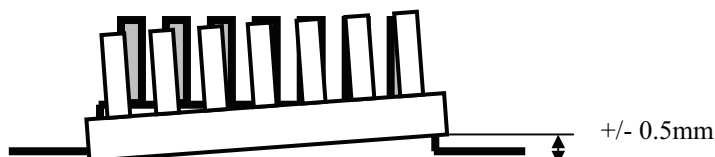
Item	Specification	Unit	Note
Active Area	331.2 (H) x 207.0 (V) (15.4" diagonal)	mm	(1)
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.2588 (H) x 0.2588 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally White	-	-
Surface Treatment	Hard coating (3H),Anti-glare	-	-

1.5 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Weight	-	272.8	282.8	g	-
I/F connector mounting position	The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

(2) Connector mounting position





2. ABSOLUTE MAXIMUM RATINGS

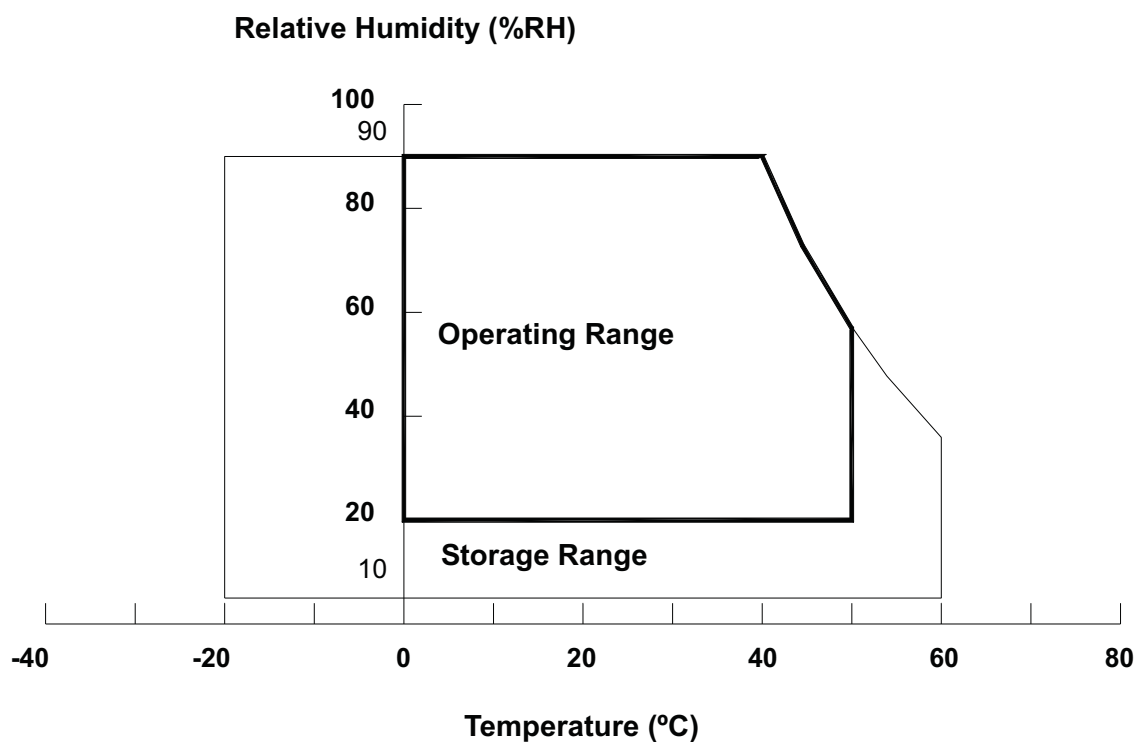
2.1 ABSOLUTE RATINGS OF ENVIRONMENT (BASED ON CMO MODULE M190E5-L0A)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)

Note (1) Temperature and relative humidity range is shown in the figure below.

- (a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).
- (b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40\text{ }^{\circ}\text{C}$).
- (c) No condensation.

Note (2) The temperature of panel surface should be 0 °C Min. and 60 °C Max.





2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

High temperature or humidity may reduce the performance of panel. Please store LCD panel within the specified storage conditions.

Storage Condition: With packing.

Storage temperature range: 25 ± 5 °C.

Storage humidity range: $50\pm 10\%$ RH.

Shelf life: 30days

2.3 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)

Item	Symbol	Value		Unit	Note
		Min	Max		
Power Supply Voltage	V_{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	$V_{CC}+0.3$	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

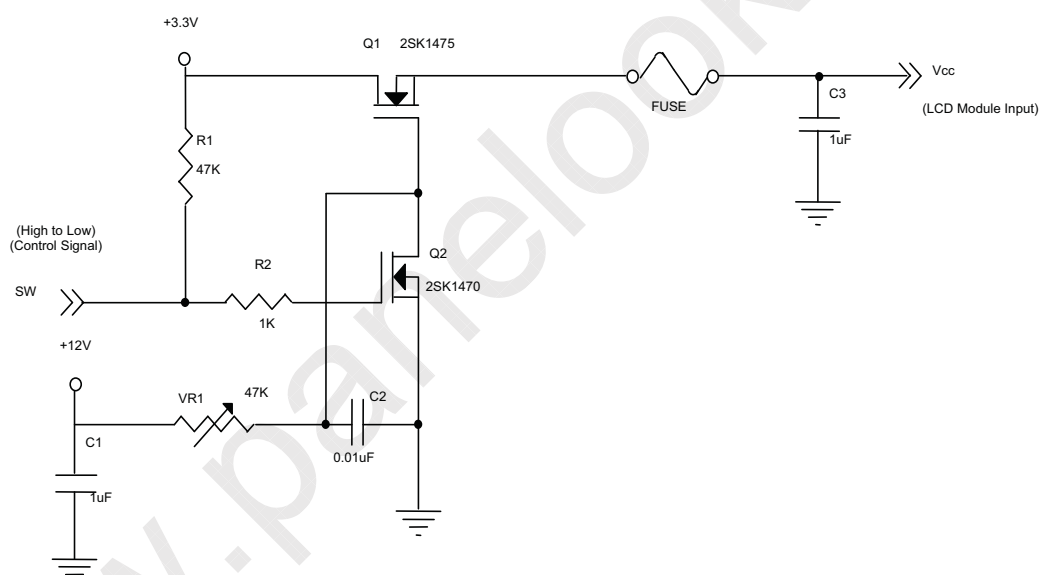
3. ELECTRICAL CHARACTERISTICS

TFT LCD MODULE

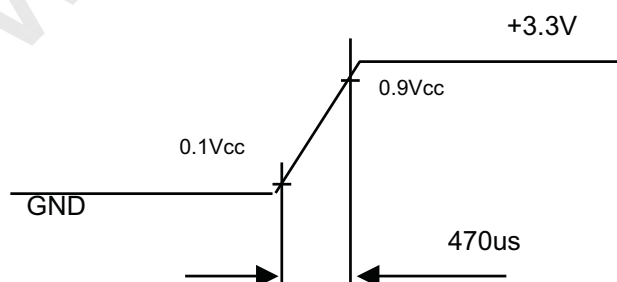
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V_{CC}	3.0	3.3	3.6	V	-
Permissible Ripple Voltage	V_{RP}	-	-	100	mV	-
Rush Current	I_{RUSH}	-	-	1.5	A	(2)
Power Supply Current	White	I_{CC}	240	-	mA	(3)a
	Black		330	-	mA	(3)b
LVDS Differential Input High Threshold	$V_{TH(LVDS)}$	-	-	+100	mV	(4), $V_{CM}=1.2V$
LVDS Differential Input Low Threshold	$V_{TL(LVDS)}$	-100	-	-	mV	(4), $V_{CM}=1.2V$
LVDS Common Mode Voltage	V_{CM}	1.125	-	1.375	V	(4)
LVDS Differential Input Voltage	$ V_{ID} $	100	-	600	mV	(4)
Terminating Resistor	R_T	-	100	-	Ohm	

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:



Vcc rising time is 470us



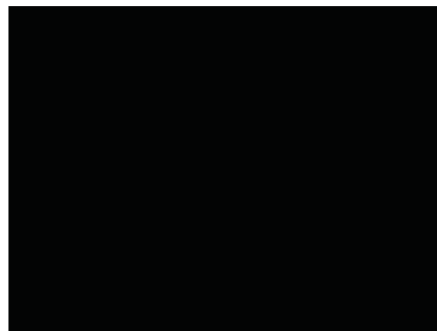
Note (3) The specified power supply current is under the conditions at $V_{CC} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



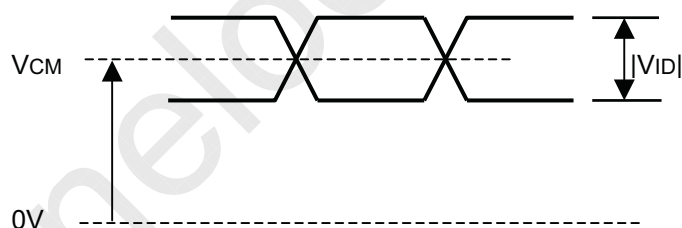
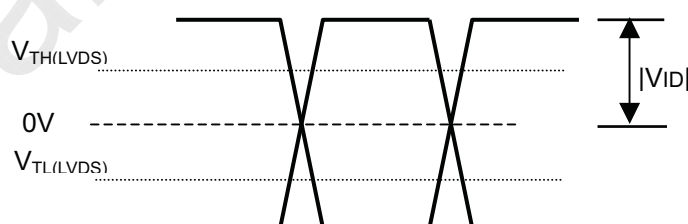
Active Area

b. Black Pattern



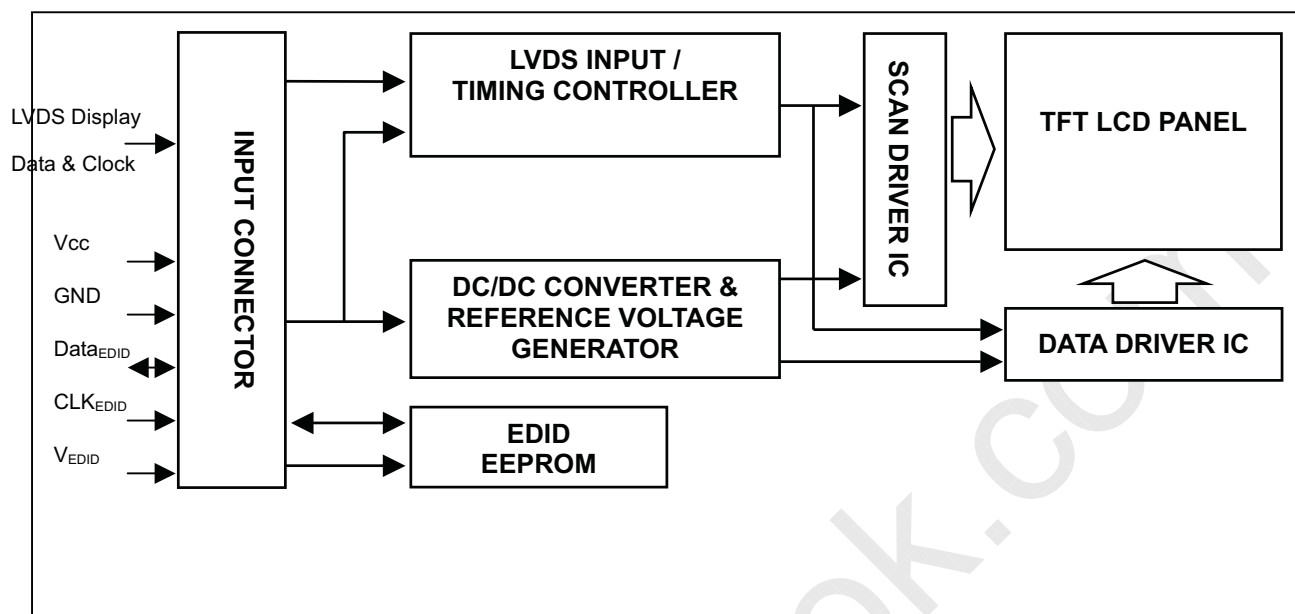
Active Area

Note (4) The parameters of LVDS signals are defined as the following figures.

Single Ended**Differential**

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE





5. INPUT TERMINAL PIN ASSIGNMENT

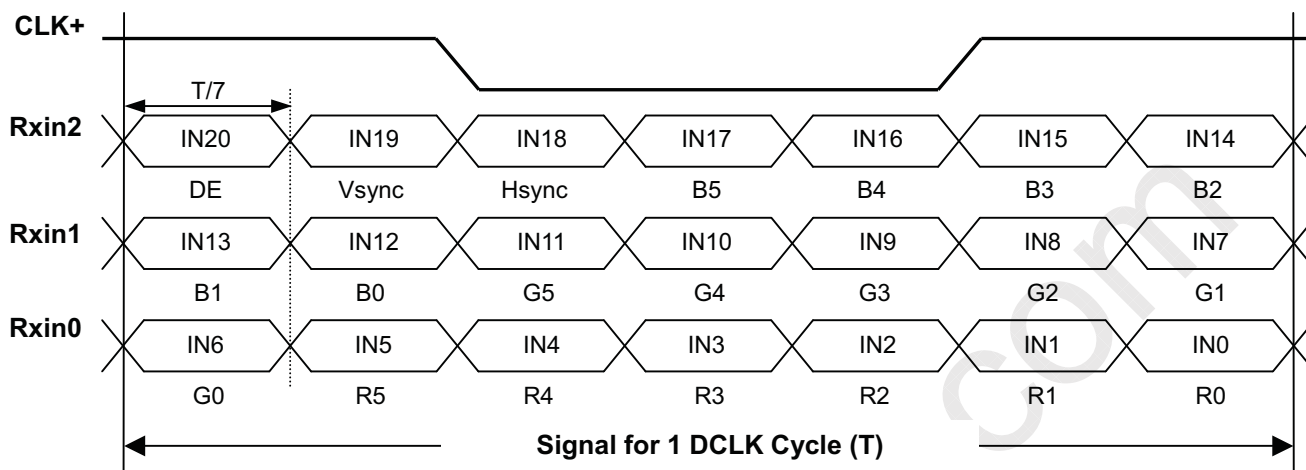
5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		-
2	Vcc	Power Supply +3.3 V (typical)		-
3	Vcc	Power Supply +3.3 V (typical)		-
4	V _{EDID}	DDC 3.3V Power		-
5	NC	-	-	-
6	CLK _{EDID}	DDC Clock		-
7	DATA _{EDID}	DDC Data		-
8	RXin0-	LVDS Differential Data Input	Negative	-
9	RXin0+	LVDS Differential Data Input	Positive	-
10	Vss	Ground		-
11	RXin1-	LVDS Differential Data Input	Negative	-
12	RXin1+	LVDS Differential Data Input	Positive	-
13	Vss	Ground		-
14	RXin2-	LVDS Differential Data Input	Negative	-
15	RXin2+	LVDS Differential Data Input	Positive	-
16	Vss	Ground		-
17	CLK-	LVDS Clock Data Input	Negative	-
18	CLK+	LVDS Clock Data Input	Positive	-
19	Vss	Ground		-
20	NC	NC	NC	NC
21	NC	NC	NC	NC
22	NC	NC	NC	NC
23	NC	NC	NC	NC
24	NC	NC	NC	NC
25	NC	NC	NC	NC
26	NC	NC	NC	NC
27	NC	NC	NC	NC
28	NC	NC	NC	NC
29	NC	NC	NC	NC
30	NC	NC	NC	NC

Note (1) Connector Part No.: JAE-FI-XB30SL-HF11 or equivalent parts.

Note (2) User's connector Part No: JAE-FI-X30C2L or equivalent parts.

5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL



5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

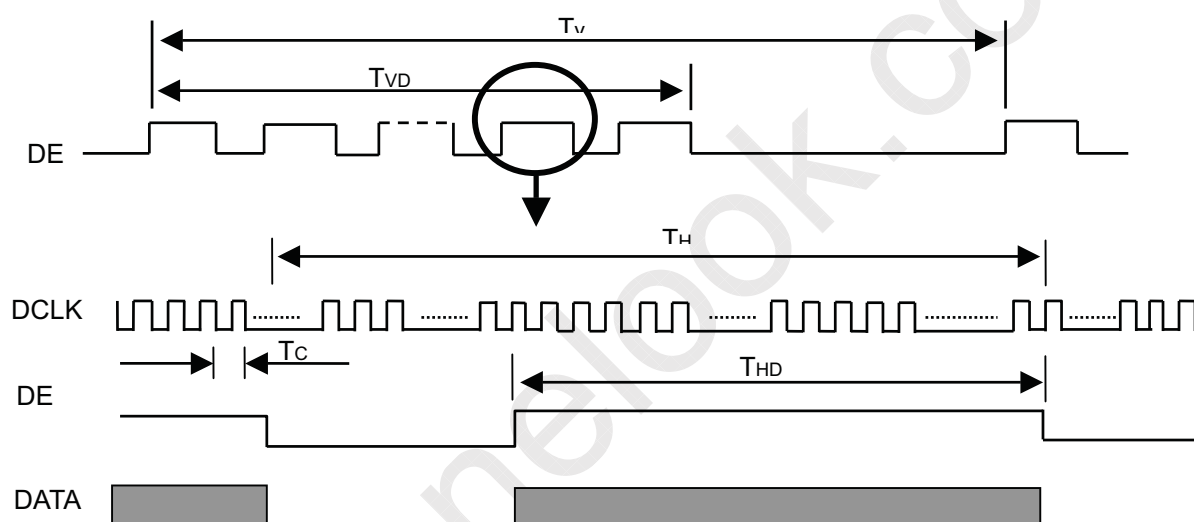
6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

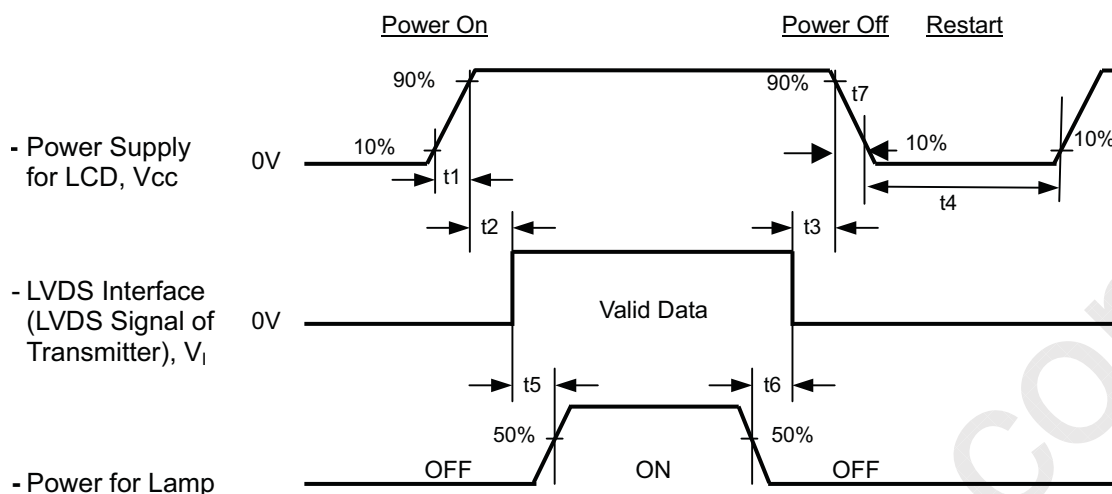
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	-	71	80	MHz	-
DE	Vertical Total Time	TV	810	823	(1000)	TH	-
	Vertical Addressing Time	TVD	800	800	800	TH	-
	Horizontal Total Time	TH	1360	1440	(1600)	Tc	-
	Horizontal Addressing Time	THD	1280	1280	1280	Tc	-

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

$$\begin{aligned}
 0.5 &\leq t1 \leq 10 \text{ ms} \\
 0 &\leq t2 \leq 50 \text{ ms} \\
 0 &\leq t3 \leq 50 \text{ ms} \\
 t4 &\geq 500 \text{ ms} \\
 t5 &\geq 200 \text{ ms} \\
 t6 &\geq 200 \text{ ms}
 \end{aligned}$$

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD V_{cc} to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the V_{cc} falling time is better to follow $5\text{ms} \leq t7 \leq 300 \text{ ms}$.



7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I _L	6	mA
Inverter Driving Frequency	F _L	61	KHz

7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown as below. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rcx	$\theta_x=0^\circ, \theta_Y=0^\circ$ CS-1000T Standard light source “C”	Typ - 0.03	0.600	Typ + 0.03	-	(0),(6)
		Rcy			0.345		-	
	Green	Gcx			0.295		-	
		Gcy			0.528		-	
	Blue	Bcx			0.140		-	
		Bcy			0.168		-	
	White	Wcx			0.308		-	
		Wcy			0.355		-	
Center Transmittance		T%	$\theta_x=0^\circ, \theta_Y=0^\circ$	7.9	8.5	-		(1), (8)
Contrast Ratio		CR	CS-1000T, CMO BLU	300	400	-	-	(1), (3)
Response Time		T _R	$\theta_x=0^\circ, \theta_Y=0^\circ$	-	5	10	ms	(4)
		T _F		-	11	16	ms	
Transmittance uniformity		δT%	$\theta_x=0^\circ, \theta_Y=0^\circ$ BM-5A	-	1.25	1.4	-	(1), (7)
Viewing Angle	Horizontal	θ _x +	CR≥10 BM-5A	40	45	-	Deg.	(1), (2) (6)
		θ _x -		40	45	-		
	Vertical	θ _y +		15	20	-		
		θ _y -		40	45	-		

7.3 Flicker Adjustment

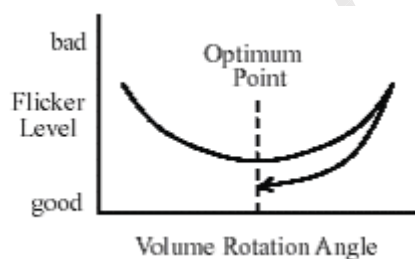
(1) Adjustment Pattern: 2H1V checker pattern as follows.

R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B



(2) Adjustment Method:

Flicker should be adjusted by turning the volume for flicker adjustment by the ceramic driver. It is adjusted to the point with least flickering of the whole screen. After making it surely overrun at once, it should be adjusted to the optimum point.

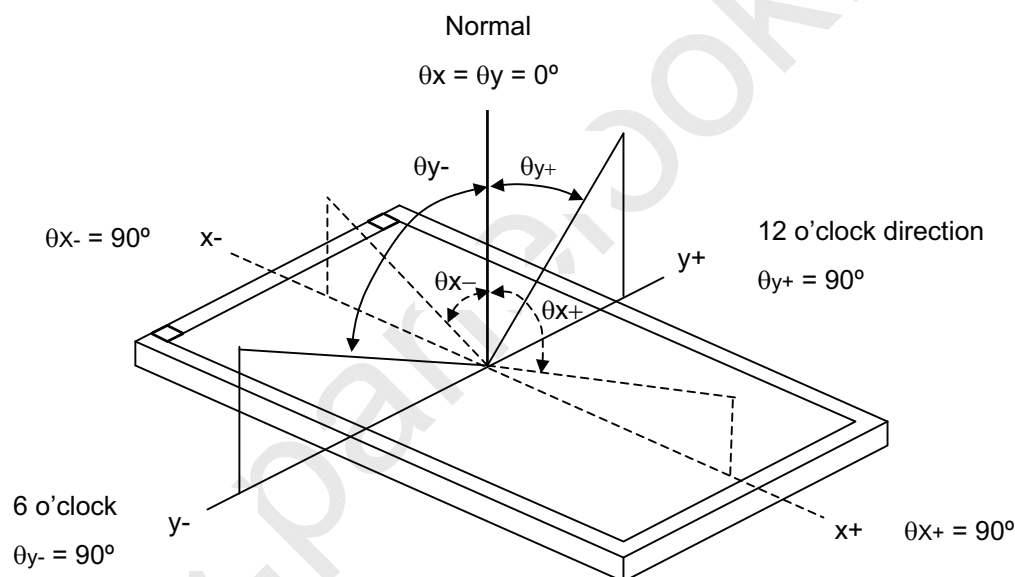


Note (0) Light source is the standard light source "C" which is defined by CIE and driving voltages are based on suitable gamma voltages. The calculating method is as following :

1. Measure Module's and BLU's spectrums. White is without signal input and R, G, B are with signal input. BLU is supplied by CMO.
2. Calculate cell's spectrum.
3. Calculate cell's chromaticity by using the spectrum of standard light source "C"

Note (1) Light source is the BLU which is supplied by CMO and driving voltages are based on suitable gamma voltages. White is without signal input and R, G, B are with signal input. SPEC is judged by CMO's golden sample .

Note (2) Definition of Viewing Angle (θ_x , θ_y):



Note (3) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

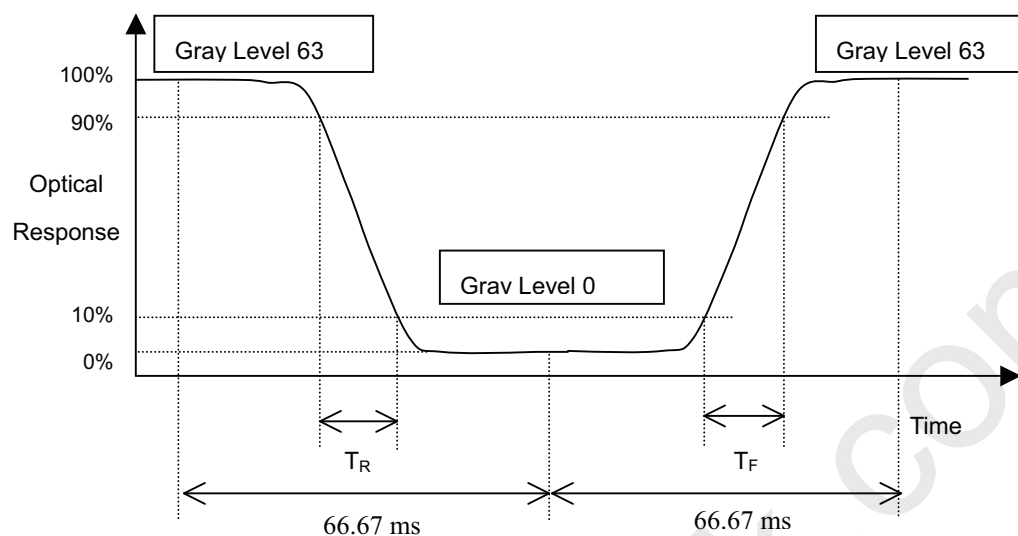
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (1)$$

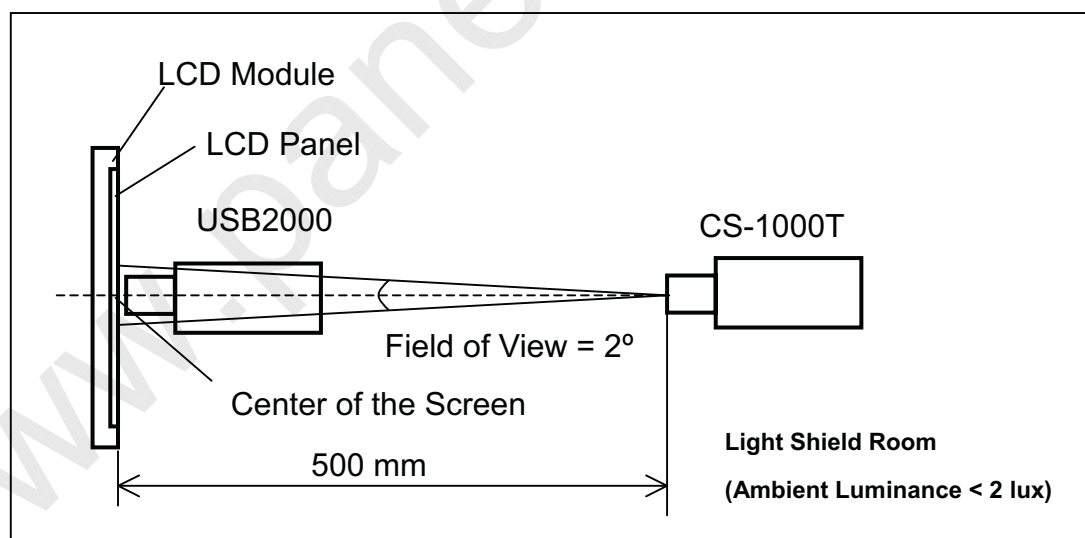
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (7).

Note (4) Definition of Response Time (T_R , T_F):



Note (6) Measurement Setup:

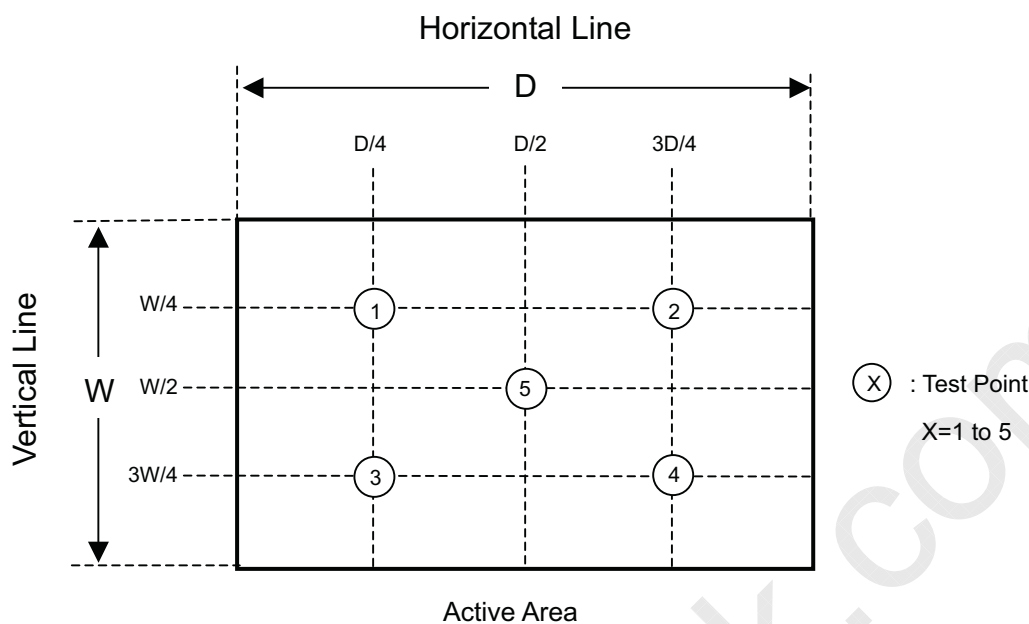
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (7) Definition of Transmittance Variation ($\delta T\%$):

Measure the transmittance at 5 points

$$\delta T\% = \frac{\text{Maximum } [T\%(1), T\%(2), \dots T\%(9)]}{\text{Minimum } [T\%(1), T\%(2), \dots T\%(9)]}$$



Note (8) Definition of Transmittance(T%):

Module is without signal input.

BLU is Supplied by CMO .

$$\text{Transmittance} = \frac{\text{Luminance of LCD module}}{\text{Luminance of backlight}} * 100\%$$

8. PACKAGING

8.1 PACKING SPECIFICATIONS

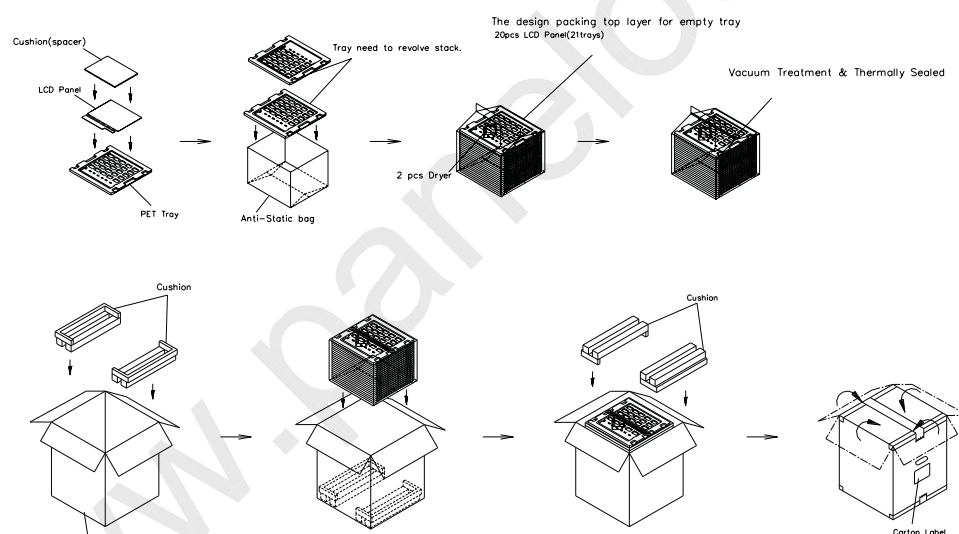
- (1) 20 open cells / 1 Box
- (2) Box dimensions: 524mm(L) X 432mm(W) X 445mm(H)
- (3) Weight: approximately 11.436Kg (20 open cells per box)

8.2 PACKING METHOD

- (1) Carton Packing should have no failure in the following reliability test items

Test Item	Test Conditions	Note
Packing Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation

- (2) Packing method.



- (1) 20 LCD+PCBA/1 box
- (2) Carton dimensions : 524(L)x432(W)x445(H)mm
- (3) Weight : approximately 10.88kg(20 Cells per box).



Doc. No.:

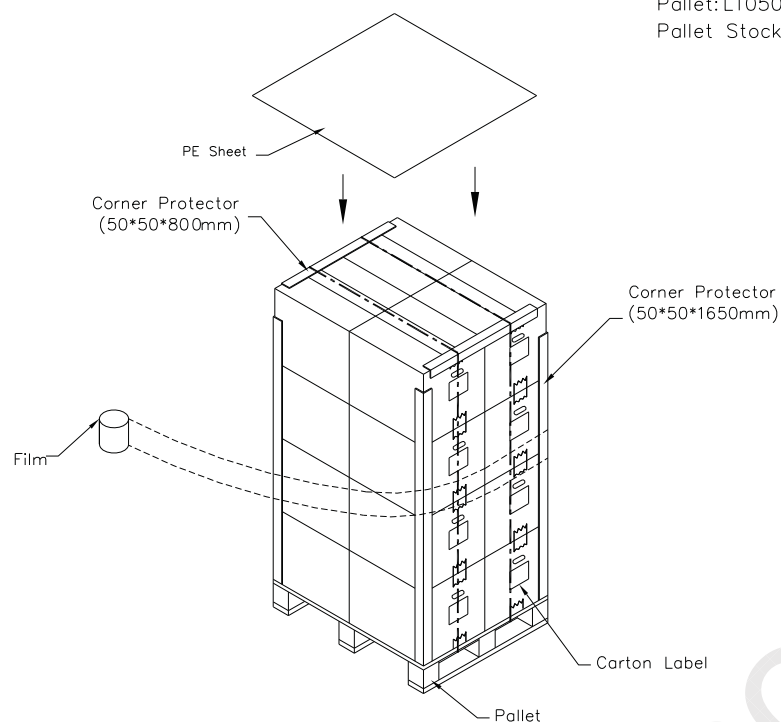
Issued Date: Sep. 06, 2006

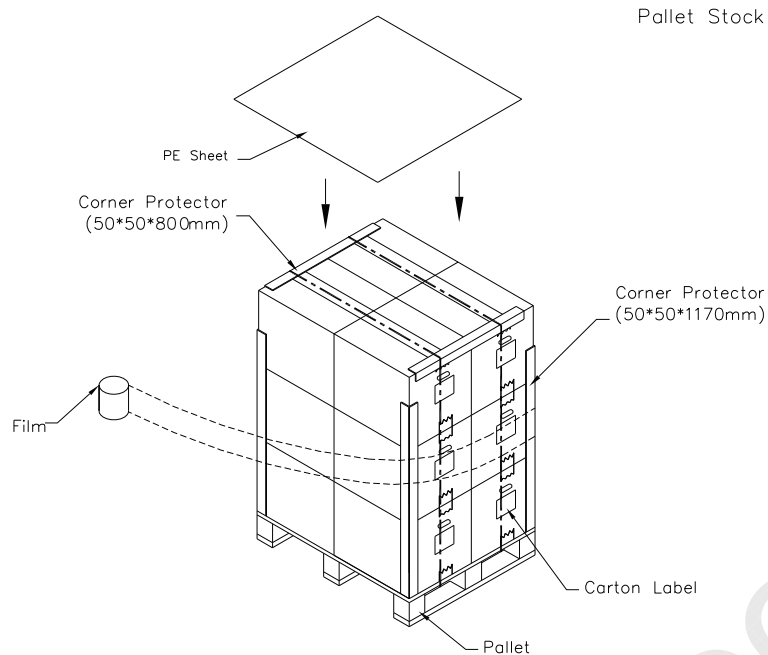
Model No.: N154I2-P02

Approval

Pallet: L1050*W870*H145mm

Pallet Stock Dim: L1050*W870*H1925mm



Pallet: L1050*W870*H145mm
Pallet Stock Dim: L1050*W870*H1480mm

9. DEFINITION OF LABELS

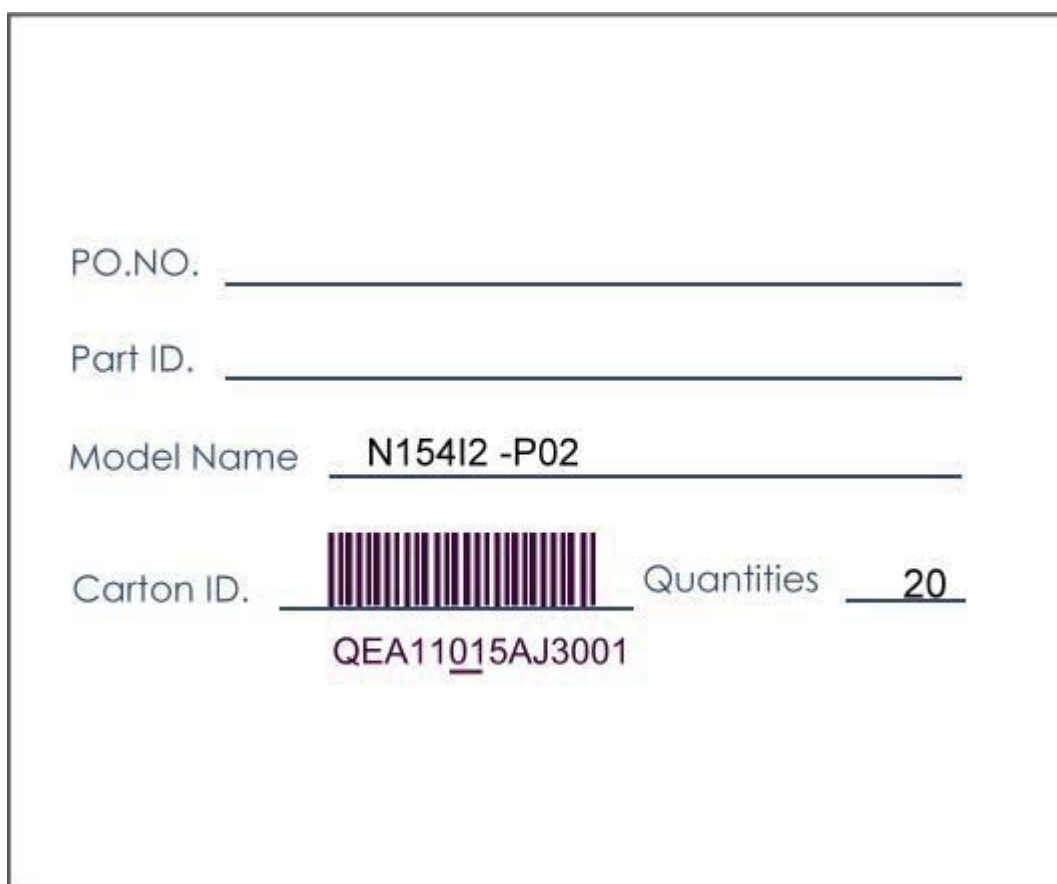
9.1 CMO PANEL LABEL

The barcode nameplate is pasted on each cell as illustration for CMO internal control.



9.2 CARTON LABEL

The barcode nameplate is pasted on each box as illustration, and its definitions are as following explanation

A large rectangular label with a black border. It contains several fields for information: 'PO.NO.' followed by a horizontal line; 'Part ID.' followed by a horizontal line; 'Model Name' followed by 'N154I2 -P02' and a horizontal line; 'Carton ID.' followed by a 2D barcode and a horizontal line; and 'Quantities' followed by '20' and a horizontal line. Below the 2D barcode, the text 'QEA11015AJ3001' is printed.

- (a) Model Name: N154I2 -P02
- (b) Carton ID: CMO internal control
- (c) Quantities: 20

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the product during assembly.
- (2) To assemble backlight or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel will be damaged.
- (4) Always follow the correct power sequence when the product is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (7) It is dangerous that moisture come into or contacted the product, because moisture may damage the product when it is operating.
- (8) High temperature or humidity may reduce the performance of module. Please store this product within the specified storage conditions.
- (9) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.

10.2 SAFETY PRECAUTIONS

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the product's end of life, it is not harmful in case of normal operation and storage.

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